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FOSSIL ANNELID JAWS FROM THE IOWA DEVONIAN

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Recently in the process of experiment on limestones from the Cedar Valley formation near Iowa City, Iowa, 0.5 n. hydrochloric acid was used to decompose the carbonates present. In the residues obtained by filtration and washing of the resulting product there were discovered some organic remains almost microscopic in size which were very similar in appearance to those of the jaws of certain groups of recent marine annelids. Further investigations revealed several complete specimens and a number of fragments which show that these remains probably are distributed quite generally through the Cedar Valley limestones. They are now known to occur not only at the horizon of the first discovery but also somewhat higher in position in the same locality and at a different horizon at Mid River several miles up Iowa river.

The first authentic record of similar buccal remains appears to have been made by Grinnell [1] in 1877. This writer described and figured two partly broken jaws which are strikingly like those of a modern *Nereis*. Hinde [2] in 1879 described and figured fifty-five jaws from the Ordovician, Silurian and Devonian of eastern North America and from the Lower Carboniferous rocks of Scotland. The following year the same writer [3] described and figured twenty-seven forms from the Silurian of England and in 1882 [4] described annelid jaws from the Silurian of Gotland. Clarke [5] in 1886 figured several jaws. His figure 23 is remarkable in that it shows partly broken maxillary plates apparently in the approximate position which the parts occupied in the living animal. A recently reported form similar to these is that of a single jaw from the Devonian of Milwaukee, Wisconsin, described and figured by Cleland [6] in 1911. Study of the Devonian forms convinces the writer that these buccal hard parts are very similar to those of annelids of the modern seas. As far as known descriptions of specimens other than those mentioned have not been included in the publications of other authors although discussions of the more doubtful types known as Conodonts are plentiful in the literature.

The specimens from the Cedar Valley limestone are minute plates of a dark brown or black color. They are so fragile that

the weight of a dissecting needle often reduces them to fragments. When known to be unbroken they are not in any case simple but are supplied with serrations, denticles, or hooks. As yet no two have been found which show marked similarity. Elevated ridges on certain of the specimens represent possibly the line of attachment to the muscular tissue of the animal whose dental apparatus they formed. The largest of these plates measures 0.925 mm. in length. Since hydrochloric acid does not attack these remains it is certain that their composition is other than calcium carbonate. Although of a chitinous appearance it is assumed that they are not composed of the original chitin.

While there is a wide variation in these mouth parts it is no greater than that present in the jaws of members of the existing family Leodicidæ to which these forms, by reason of close similarity, appear to be closely related. Ehlers [7] used the jaws of the Leodicidæ (Eunicidæ) as a basis of classification. Treadwell is of the opinion that "While regarded by some students of the family as too variable in individuals and too similar in different species to be of value in classification," he has "found that while such details as the number of teeth in a plate may vary, the general appearance and the arrangement of parts of these structures are decidedly characteristic in any species." [8] He adopts a plan (page 7) of terminology for the description of mouth parts in which he calls the dorsal plates "maxillæ" and the ventral parts "mandibles" (page 8.). The posterior maxillæ, the proximal paired plates, and the distal paired plates, or the ventral mandibles, may be sufficiently characteristic to permit differentiation on the basis of these parts. However, unpaired maxillary plates would apparently be of little value for specific or generic classification, especially if detached from their adjacent more constant paired plates.

A comparison of the fossil Iowa forms with jaws shown in Treadwell's text figures of the Leodicidæ brings out certain facts. The specimens figured in this paper as numbers 4, 5 and 7 although at first sight dissimilar have characteristics which associate them directly with the proximal paired maxillary plates of many species of Leodicidæ, especially of the genera *Leodice, Marphysa, Paramarphysa, Nematonereis* and *Lysidice*. These plates in common with the parts of recent genera show a sub-crescentic posterior or postero-lateral outline. In the Leodicidæ these maxillæ are oriented with this concave margin in a lateral or postero-lateral position and the denticle-bearing edge falls along the median line with the denticles normally directed posteriorly. If the fossil maxillæ be

substituted in the jaw scheme mentioned with the same orientation with the concave margin in the same relative position the denticles will fall along the median line and the denticles or serrations will be directed posteriorly in the same manner. Numbers 1 and 2 are somewhat similar to the proximal paired plates of other living species but the resemblance is not so marked. The fragments figured as 8 and 9 have also an expression like those of the posterior maxillary plates of certain species. Perhaps the most interesting of the specimens figured is number 3. Morphologically this individual is highly suggestive of the mandibles or lower pharyngeal jaws of some members of the genus *Diopatra* as figured by Ehlers (Plates 17, 19 and 20). As Treadwell observed, each of the two mandibles of the leodicid polychæts is made up of a proximal cylindrical part and a distal bevelled plate. The specimen figured agrees with the form of certain *Diopatra* even to the presence of antero-lateral serrations on the bevelled plate. Larger much broken parts found with those figured may represent the forceps plates but are too fragmentary to make accurate comparison possible.

These comparisons of the Devonian forms with pharyngeal jaws of modern polychæts seem to indicate that the variation between the ancient and modern annelid jaws is but little greater than the variations among the members of apparently closely related recent genera. It is likely that differences as great as those present among modern forms were present in the buccal hard parts of the ancient annelids. Therefore until more material has been obtained it does not seem profitable to attempt generic and specific descriptions of the Devonian forms at this time. Etching with acid of limestones known to contain these remains may result in the discovery of dental plates in place although no results have yet been obtained in this manner.

Calculation may give some hint as to how numerous these animals were during Cedar Valley time. In the experiments during the course of which these fossils were found the unit of limestone used was 50 gm. Taking 2.5 as the specific gravity of the limestone the volume is 20 cc. or approximately one cubic inch. The majority of the specimens figured were obtained from a single sample of rock. The bed in which the remains were found is over five feet in thickness. In a bed of a thickness of five feet covering one square mile the volume of limestone is roughly 24 $x10^{10}$ cubic inches. Assuming very conservatively that the jaws in one cubic inch represent but a single individual, the remains in

the given square mile of limestone with a thickness of five feet will represent a number of annelids equal to the number of cubic inches of volume. Supposing that five hundred years were required for the deposition of the bed of limestone, and that the average length of life of each individual was one year, then approximately 5×10^8 individuals lived over a square mile of sea bottom at any one time. In other words approximately 20 annelids lived upon a foot of sea bottom during this part of Devonian time. What a feast for a rapacious Devonian fish these soft bodied morsels might have made! These figures are purposely made conservative. The specimens from a sample certainly represent more than one individual. Many were doubtless overlooked and several were broken when the attempt was made to remove them from the residue. There is no reason to suppose that the acid treatment used did not remove a number of specimens that might have been preserved in calcium carbonate. It is, of course, likely that these forms were more abundant in one locality than in another but samples from four horizons north of Iowa City yielded these fossils and another horizon several miles up Iowa river at Mid River furnishes evidence that these annelids were a most abundant type of life during the Devonian.

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